

3.035 Development of Online Continuous Relaxed Eddy Accumulation System Coupled with Ion Chromatographs.

Early Career Scientist

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Abstract:

A relaxed eddy accumulation system coupled with ion chromatographs (REA-IC) was constructed and optimized to capture the flux of ammonia and other water-soluble gases. The instrument assembly is based on the ambient ion monitoring ion chromatographs (AIM-IC) adapted following Markovic et al. (2012). The system uses wet parallel plate denuders to capture water-soluble gases, namely NH_3 , HNO_3 , HONO, HCl, and SO_2 followed by automated IC analysis every hour. Conditional sampling of up- and downdrafts is achieved using data acquisition system developed by Pattey et al. (1996) coupled with a sonic anemometer. REA fluxes are calculated using concentration difference between up- and downdraft reservoirs, standard deviation of the vertical wind speed, and a proportionality factor. Accurate flux measurements using this technique requires excellent precision between the respective reservoirs. Based on REA simulations that are informed by eddy covariance NH_3 fluxes over maize crops following fertilization, maximum fluxes of $\sim 50 \text{ umol m}^{-2} \text{ h}^{-1}$ leads to a concentration difference of less than 30% between the two reservoirs, emphasizing the need for high measurement precision. Preliminary lab tests showed a relative precision of $\sim 10\%$ for NH_3 and HONO concentrations measured in both up and downdraft reservoirs. Normalization based on a lithium bromide (LiBr) internal standard made an improvement on the precision. The use of LiBr also facilitates diagnosis of the instrumentation and background influence of the denuder assemblies. Preliminary field tests were carried out in an agricultural area during the growing season over maize crops that had been fertilized by urea. The ability to resolve NH_3 fluxes can help assess the utility of different agricultural management practices.